

## CLAIMS

1. A sensor protein comprising an insert-type fusion protein composed of a reporter protein and a binding protein wherein said binding protein is inserted into the amino acid sequence of said reporter protein.

2. The sensor protein according to Claim 1, wherein the binding protein is a protein having a size of 100 to 1000 amino acid residues in length.

3. The sensor protein according to Claim 1 or 2, wherein the binding protein is a protein selected from the group consisting of metal ion-binding proteins, DNA-binding proteins, cAMP-dependent protein kinase, cGMP-dependent protein kinase, hydrolase, ATP-binding proteins, GTP-binding proteins, nitric monoxide synthase, glucose-binding proteins, maltose-binding proteins, hormone receptors, single chain antibodies and chaperons; or a functional fragment thereof or a mutant thereof.

4. The sensor protein according to any one of Claims 1-3, wherein the reporter protein is an enzyme protein, a fluorescent protein or a fluorescence-labeled protein, or a mutant thereof.

5. The sensor protein according to Claim 4, wherein the enzyme protein is an enzyme protein selected from the group consisting of protease, nuclease, alkaline phosphatase,  $\beta$ -galactosidase, luciferase, glucose oxidase, chloramphenicol acetyl transferase and peroxidase, or a mutant thereof.

6. The sensor protein according to Claim 4, wherein the fluorescent protein is Green Fluorescent Protein, Red Fluorescent Protein or a mutant thereof.

7. The sensor protein according to Claim 6, wherein the binding protein is inserted between the amino acid residues of 128 Ile-205 Ser of Green Fluorescent Protein which is the reporter protein.

8. The sensor protein according to Claim 4, wherein the fluorescent-labeled protein is a protein labeled with a fluorescent dye selected from fluorescein series, rhodamine series, eosin series and 7-nitrobenz-2-oxa-1,3-diazole (NBD) series; or a mutant thereof.

9. The sensor protein according to Claim 1, which is comprised of an insert-type fusion protein formed by inserting the amino acid sequence of aryl hydrocarbon (Ah) receptor into the amino acid sequence of alkaline phosphatase.

10. A nucleic acid encoding the protein according to any one of claims 1 to 9.

11. A method of preparing a sensor protein, comprising the steps of:

- (a) inserting a DNA encoding a binding protein into a DNA sequence encoding a reporter protein; and
- (b) expressing the resultant DNA encoding an insert-type fusion protein.

12. A method of preparing a sensor protein, comprising the steps of:

- (a) inserting a DNA encoding a binding protein into a DNA sequence encoding a reporter protein;
- (b) introducing mutation into the resultant DNA sequence encoding an insert-type fusion protein to obtain a population of mutants of the DNA sequence encoding the insert-type fusion protein;
- (c) expressing the population of mutants of the DNA sequence encoding the insert-type fusion protein to obtain a population of mutants of the insert-type fusion protein; and
- (d) selecting an insert-type fusion protein having a desired function from the population of mutants of the insert-type fusion protein by detecting a change in the detection signal generated from the reporter protein by the action of a target substance to

the binding protein.

13. The method according to Claim 12, wherein the steps (b), (c) and (d) are repeatedly carried out.

14. A sensor protein prepared by the method according to any one of Claims 11 to 13.

15. A nucleic acid encoding the protein according to Claim 14.

16. An expression vector containing the nucleic acid according to Claim 10 or 15.

17. A transformed cell having the expression vector according to Claim 16.

18. A method of preparing a sensor protein, comprising the steps of:

culturing the transformed cell according to Claim 17; and harvesting said sensor protein from the culture.

19. A method of detecting or determining a target substance, comprising the steps of:

reacting the sensor protein according to any one of claims 1 to 9 and 14 with said target substance; and

measuring a change in the detection signal generated from the reporter protein that constitutes the sensor protein.

20. The method according to Claim 19, wherein the reporter protein is a fluorescent protein.

21. The method according to Claim 19, wherein the detection signal is fluorescence.

22. The method according to any one of Claims 19 to 21, wherein detection or determination of the target substance is carried out in a living cell, tissue or individual.

23. The method according to Claim 19, wherein the sensor protein is an insert-type fusion protein formed by inserting the amino acid sequence of Ah receptor into the amino acid sequence of alkaline

phosphatase, and the target substance is dioxins or polychlorinated biphenyl.

24. The method according to Claim 19, wherein the sensor protein is an insert-type fusion protein formed by inserting the amino acid sequence of calmodulin into the amino acid sequence of a fluorescent protein, and the target substance is a calcium ion.

25. The method according to Claim 19 wherein the sensor protein is an insert-type fusion protein formed by inserting the amino acid sequence of a single chain antibody into the amino acid sequence of alkaline phosphatase, and the target substance is an antigen.

26. A reagent kit for performing the method according to any one of Claims 19 to 24, which comprises the sensor protein according to any one of Claims 1 to 9 and 14 or the nucleic acid according to Claim 10 or 15.